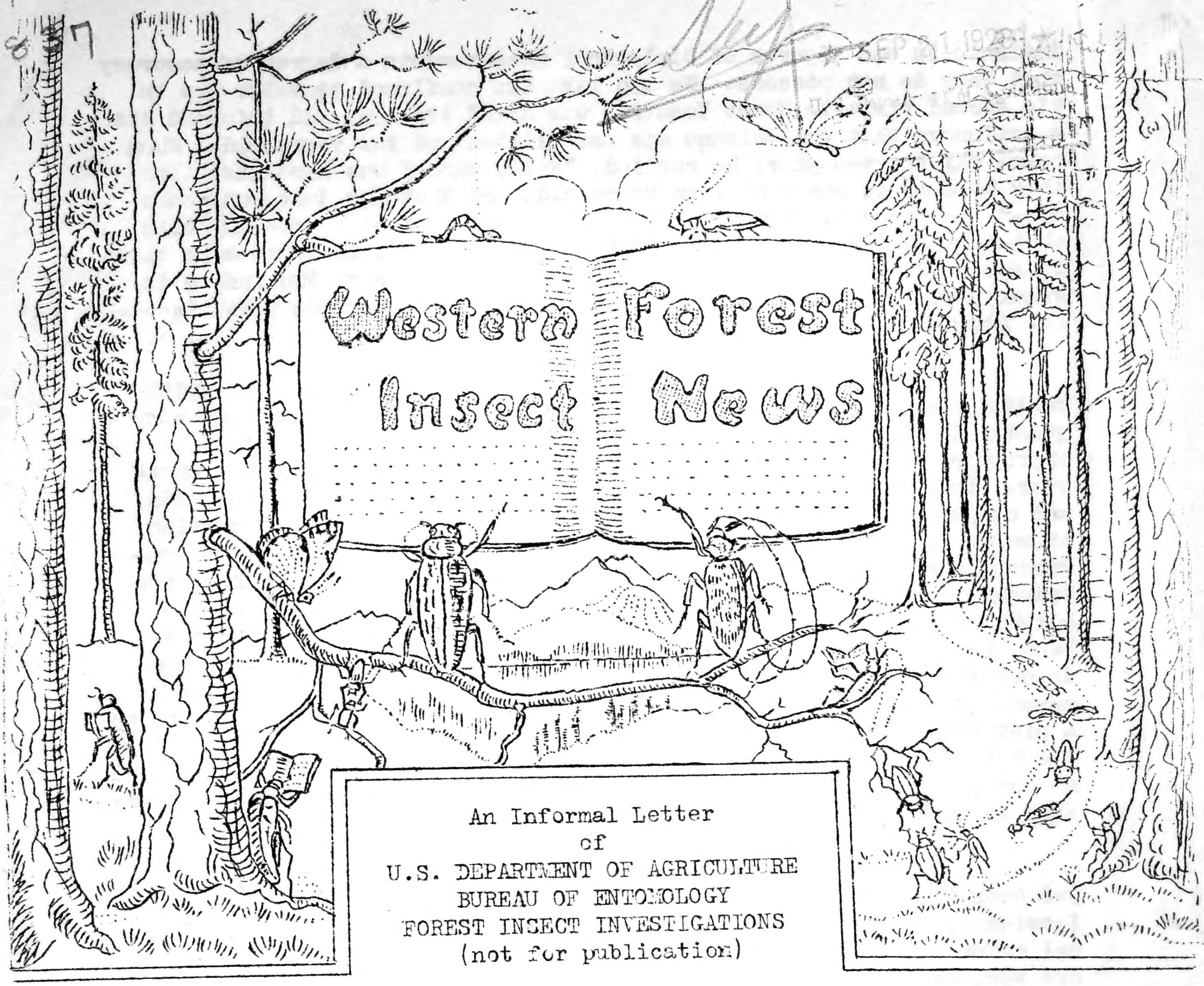


423 Jordan Hall, Stanford University, Calif., May 1, 1928

FIGURES NEVER LIE, BUT--

by F.P. Keen

The old adage states only half the truth, for the corollary is also true that "Figures sometimes lie when honest men figure". At least, when figures are used without regard to their significance they can be very misleading if not positively dishonest. Even when used by a worker whose intentions are of the best they may lead to erroneous conclusions; and when used by a worker who is out to prove his point--well, no gambler with a stacked deck can be more deceitful.

Let us begin with the numbers themselves. What's the difference between 100 and 100.0? In the strict mathematical sense there is none, but when applied to the measure of biological or physical phenomena there is a great deal of difference. The first figure means that our measure is accurate to the nearest hundred, perhaps; but the second means that it is accurate to the nearest tenth. Too frequently we

indicate in our figures of biological measurements a degree of accuracy that they do not possess. We are like the confirmed traveler who on his second visit to Mount Vesuvius was asked its age, and informed his questioners that the volcano was one million and two years old. When asked why the two years he replied, "Well, when I was here last time they told me it was a million years old, and that was just two years ago." In general, figures should not indicate greater accuracy than that possessed by the original data. For instance, if we measure the diameter of trees with a Biltmore stick to the nearest two inches it is simply absurd to write down an average figure which reads "15.7 inches" for instance.

Then take the sad case of the much abused average or arithmetical mean. The conception of an average is easy to grasp and consequently is universally used, and very frequently used when it is an inappropriate measure or, even worse, when it has no significance whatever. No entomologist of mature years would dream of averaging cats and apples, but some have been known to do worse things when handling averages of more abstract terms. A group to be averaged must be homogeneous and show some tendency to cluster about a central point. For instance, we could not expect a significant result by averaging the height or diameter of mature yellow pine with yellow pine seedlings. Even though all are yellow pines, and not cats and apples, still they do not form a homogeneous group and an average would have no significance. Nor again, if we measured the height of all the yellow pines on a plot from seedlings on up to mature trees, should we secure an average height figure that would have any significance, since the group had no central tendency. How many times have we been guilty of using averages in such ways or worse?

Nowadays there is a large school of investigators who like to put everything in the form of a chart or graph. A graph looks so professional, and tends to impress the uninitiated with the highly technical nature of the study and the erudition of the investigator. Graphs are very useful vehicles, but they are dangerous vehicles as well. A graph to be of value should clarify the data presented and make them more readily assimilable. But all too frequently they only confuse the issue through wrong legends, the wrong use of abscissae and ordinates or the wrong scale, and in other cases present the data in such a way as to make them positively misleading. Once again there is need for judgment and caution.

But our greatest crime is when we draw conclusions from averages or figures based on inadequate data. No average is worth a continental unless it is accompanied by some measure of its dispersion or probable error. Too many investigators are prone to neglect the significance of their figures or consider the reliability of the basis. They go into the field, draw a sample from the universe under consideration, measure it laboriously and accurately, draw graphs of it from every possible angle, and on the bold assumption that the sample is representative draw their conclusions and consider that the matter is settled and the problem solved. Which, to put it mildly, is a very risky business. The very next sample just around the corner, or the one taken next year, may simply reverse the conclusions, to the great chagrin and discredit of their discoverer. If the sample is just one

in a million and entirely inadequate as a base for even a reasonable assumption, wouldn't it be better to present it frankly as such and not leave the impression that it is representative of the general case? Misrepresentation can just as easily be committed by omission as by commission.

Statistical methods that have been developed rather recently by economists and psychologists are valuable tools for unraveling entomological problems that involve the handling of quantitative data. Without some knowledge of the use of these tools very little worthwhile progress can be made in the solution of problems involving the effect of a great number of factors; while on the other hand, if these tools are carelessly handled they may do serious injury to the finished product, to say nothing of pefsonal injuries to the workmen. When statistical methods are used there is always the danger that the measures secured will be accepted at their face value, without proper consideration of their limitations or the accuracy of the original data. Statistical methods can be applied only when certain rules have been adhered to; they can give no indications of the bias of the original data or the errors of observation--errors that are often of more importance than the errors of simple sampling. While statistical methods furnish us good and useful tools, they must not be used recklessly or carelessly

It would be easy enough to go on for several more pages pointing out the pitfalls on the road of the investigator who turns to mathematics for his weapons of warfare. Much might also be related of the tragic fates that have overtaken many a noble and well-intentioned crusader. But your imaginations are good, so I shall leave them in your tender care and urge upon you that you profit by their mistakes and gird yourselves well for any venture you may undertake in this field of endeavor. In the matter of such presentation I can do nothing better than refer you to Mill's "Statistical Methods". It not only covers the subject adequately, but is a clear and readable presentation. Read it carefully, and then when you start wrestling with figures treat them with due consideration for their frailties, bearing in mind as well their fundamental and inherent honesty.

CONE MOTH DESTROYS WHITE PINE SEED

In certain areas within District 1 which in the past have been selected for gathering white pine cones, the cone moth, Eucymatoge spermaphaga Dyar, has become an important consideration. The damage to cones has been steadily increasing during the past ten years, and during last season practically the entire crop was ruined. It is reported that as a result of the attacks of this insect the cones shrivel up and set, and cannot be opened by heat. J.C.E.

IT TAKES A FOREST ENTOMOLOGIST TO TURN THE TRICK

For several years there has been evidence of the presence of a porcupine in the Nebraska Forest plantations. Quite a few trees were barked and some were entirely girdled and killed by some animal whose work was identified by the Biological Survey as that of a porcupine. The porcupine was never seen by anyone during the past several years until Forest Entomologist L.C. Baumhofer ran on to him and captured, killed and photographed him. It is not known whether this specimen wandered up one of the river valleys from the Platte or the Missouri, or whether he came across the prairie from the Black Hills. (Service Bulletin, March 26, 1928)

YELLOW PINE INFESTATION IN DISTRICT 6

In Washington, the worst beetle epidemic is in Okanogan County, in the north-central part of the state. Here the western pine beetle (D. brevicomis) and the mountain pine beetle (D. monticolae) have killed at least half a billion board feet of western yellow pine in the last ten years. Most of the area is within the Chelan National Forest. The present market value of the timber is perhaps even less than $3.00 per M board feet. The scarcity of insect control funds makes it impossible to do control work now in timber of such low value.

In Oregon, the big problem is still centered in Klamath and Lake Counties, in the southern part of the state on portions of the Fremont and Crater National Forests, the Klamath Indian Reservation, and considerable areas of privately-owned yellow pine. However, the Deschutes National Forest of central Oregon, the Malheur and Whitman National Forests in northeastern Oregon and the Mount Hood National Forest in northwestern Oregon contain epidemics of the western pine beetle that need watching and may require control work. A.J.J.

WHERE WERE THE PARK OFFICIALS?

National Park Service Conference.--The forestry session of the National Park Service Conference was recently held at the University of California, at Berkeley. The meeting featured programs of general forestry and forest fire protection. Among the speakers were Dr. W.W. Campbell, President of the University of California; Walter Mulford, Dean of the Division of Forestry, University of California; M.B. Pratt, State Forester for California, and Dr. E.P. Meinecke, United States Bureau of Plant Pathology. (Clipped from American Forests and Forest Life, April 1928.)

DISTRICT INVESTIGATIVE COMMITTEE, D. 6

The District Investigative Committee of the Forest Service held its annual meeting at Portland, Oregon, on February 28 and 29. Jaenicke presented that part of the research of the bureau at the Idaho and California stations that had direct applicability to Oregon and Washington forest insect problems. The district report contains a brief summary of this research and seven project sheets. These project sheets cover research on:

1. Improvement of barkbeetle control methods
2. Elimination of beetle loss through marking
3. Interrelation of insects and slash in yellow pine
4. Defoliators
5. Drought in relation to beetle epidemics
6. Relation between fires and beetle activity
7. Regional survey of insect damage.

A.J.J.

WHEN IS AN INSECT PRIMARY?

Usually when we speak of a primary insect in forest entomology we refer to an insect that attacks an uninjured tree and kills it. A secondary insect is one whose attacks follow those of a primary insect, or the injury of the tree by fire, disease, drought, high water, etc. What shall we call the insects that are able to attack an uninjured tree, but seldom able to kill it unless assisted by secondary insects? One insect of this class is the lodgepole pine beetle, *Dendroctonus murrayanae* Hopk. This beetle attacks the bases of numerous perfectly healthy appearing lodgepole pines in Wyoming and Montana. Apparently nothing serious comes of the attack, however, unless it is followed by an attack of the Oregon engraver beetle, *Ips oregoni* (Eich.) Economically speaking, the primary *Dendroctonus murrayanae* is secondary and the secondary *Ips oregoni* is primary. H.E.B.

APPRAISAL BEING MADE OF BEETLE-KILLED YELLOW PINE

Mr. John Berry and B.O. Hughes of the Forest Service and F. P. Keen of the Bureau of Entomology will be engaged during the first part of May on a timber appraisal of the infested areas of the Modoc National Forest. The object of the survey will be to estimate the probable salvage values of the trees killed during the epidemic period from 1925 to 1927.

SLASH AND INSECTS IN THE SOUTHWEST

The item entitled "Another Angle of the Slash Problem" appeared in Western Forest Insect News is of interest in the Southwest. Observations here are similar to those recorded in the item. We have three species of Ips (confusus, integer and calligraphus) and studies of their life history indicate at least two full broods and usually a third, or partial third. During the recent drought, localized epidemics were common in the vicinity of fresh slash, and one was found near a lightning-struck tree. Another of which I have personal knowledge occurred around a newly-built summer home where unseasoned pine lumber was used. I have been informed that several other summer home people have been greatly disappointed in the loss of blackjacks surrounding their new cabin of unseasoned lumber.

The loss in groups of young trees surrounding a lightning-struck pine or a green-pine lumber cabin seems to indicate that the insects are attracted by the odor of the green pine. Observations in the Southwest appear to indicate that Ips breed in slash and go from slash to slash. Thus it is seldom that an attack is noted on a continuous operation, while on a large sale closed down in the middle of the summer the loss was rather heavy. Leaving the tops without any brush disposal seems to favor broods, while lopping the branches and throwing the larger branches out into the open retards the development of the brood and only a few adults emerge. Drying of the branch and the solar heat(where the bark is not too thick)seems to get the brood.

While on the Prescott National Forest (1920 to 1926) I observed fully a hundred local attacks, but do not recall a single instance of a spread of the killed area after the initial kill.

We endeavor to secure a clean-up of the slash as well as slabs just prior to the emergence of the brood. Summer home people are advised not to use green unseasoned lumber in any construction work at their home site. Tops and large branches are removed as cordwood to a large extent and this helps in keeping the numbers down. Ips undoubtedly prefer slash, so why not keep the felling operation continuous and give it to them and burn them where possible or expose to sun?

Ranger McNelty on the Prescott has made quite a study of the Ips problem and is not entirely satisfied with the efficacy of the solar heat method. He plans further trial during the coming year.

--H. Basil Wales, D-3.

(We are glad to get this from a forest officer, and hope that others will go and do likewise. According to the latest taxonomy, <u>Ips confusus</u> from Arizona is now <u>Ips lecontei</u> Sw., and <u>Ips calligraphus</u> from there is <u>Ips ponderosae</u> Sw.--Editor)

REGIONAL FOREST PROTECTION BOARD OF OREGON AND WASHINGTON

The board for Oregon and Washington is organized along lines similar to the boards for other regions. The first meeting was held in Portland, Oregon, on March 19. Considerable attention was devoted to the forest insect situation. Messrs. Lee Muck and William Zeh described the epidemic in the yellow pine of the Klamath Indian Reservation, and Jaenicke covered the problem in the national forest and public domain areas in Oregon and Washington. A report is to be prepared for the next meeting on June 5 covering the research needs of the Bureau of Entomology and control estimates for all classes of federal lands in Oregon and Washington.

The officers of the board are: Chairman, O.A. Tomlinson (National Park Service; Vice Chairman, C.M. Granger (Forest Service); Secretary, A.J. Jaenicke (representing the Bureau of Entomology) A.J.J.

FORMER MEMBER DIVISION OF FOREST INSECTS WINS PORTRAIT CONTEST

W. N. Dovener, chief scientific illustrator of the Bureau of Entomology, formerly an illustrator for the Division of Forest Insects, was awarded the highest honors in the competitive contest for a life-size painting in oil of Hon. Isaac Newton, the first Commissioner of Agriculture of the United States. The painting was desired as an art memorial of Commissioner Newton, who held office from 1862 to 1867. The contest was staged by the illustrators of the Department, and Mr. Dovener received the unanimous decision of the judges, who were Dr. W. H. Holmes, director of the National Gallery of Art; R.S. Merryman, director of the Corcoran Gallery of Art; and Henry Bush-Brown, sculptor.
H.E.B.

THE SPRUCE BUDWORM IN WASHINGTON AND OREGON

It is becoming increasingly evident that this insect is quite generally distributed in eastern Oregon and eastern Washington; it has not been foundaanywhere in the western portions of these states. Its activity in eastern Oregon and eastern Washington has been confined to forest types of little commercial value; but of what the insect is capable if it became established in the Douglas fir forests of the region is anybody's guess. A.J.J.

LODGEPOLE PINE INFESTATION IN DISTRICT 6

In 1927 there was some diminution in the tremendous lodgepole infestation of D. monticolae, which for several years has been active on many thousands of acres in Oregon and Washington. Forests of beetle-killed lodgepole are fire-traps of the worst sort. Unfortunately, these killings are close enough to valuable yellow pine timber to complicate the fire protection problem. Lodgepole is not now an important commercial tree in the Pacific Northwest, but it has a future. Especially in northern Washington, lodgepole forests have watershed value in the high mountain areas, and there the beetle activity may have a real effect on the water-holding capacity of slopes that supply water to irrigated farm lands. A.J.J.

RELATIONSHIP OF BARK AND AIR TEMPERATURES

Experiments conducted at the Palo Alto Station have proved that certain low temperatures are fatal to the overwintering larvae of Dendroctonus brevicomis. In cooperation with the Palo Alto Station an experiment to determine the relationship of bark and air temperatures was started at the Coeur d'Alene Station on December 14, 1926.

A yellow pine containing overwintering broods of the western pine beetle was selected for this experiment. To place the thermometers in the tree a section of bark 6x8 inches was removed from the north and south exposures, and small holes were bored vertically in the inner bark. The thermometers were inserted in the holes down to the zero reading and carefully packed with bark dust. A narrow vertical groove was cut in the inner portion of the section of bark removed and this piece used as a cover for the exposed portion of the thermometer. All interstices were packed with cotton, which was replaced after each reading. Hourly readings from 8 a.m. to 5 p.m. were taken on December 14 and 15, 1926, and January 21 and 22, 1927, these being the only four days when zero weather was recorded during the winter.

The equipment used for the experiment at this time, while the best available on short notice, was not entirely suitable for this class of work; and as the lowest air temperature recorded on the selected site was only -3° it was deemed advisable to continue the experiment during the winter of 1927-28, with more suitable equipment and with a possible lower temperature.

A large yellow pine tree infested with Dendroctonus brevicomis was again selected for this experiment, which was started in December, 1927. Thermometers of the glass-rod type were placed on the north and south exposures in the same manner as described for 1926. Small holes were also bored at an angle through the bark for all exposures, and bulbs of thermometers inserted to the depth of the overwintering larvae.

Reference is made to the following table, showing the temperature readings for December 31, 1927, and January 1, 1928, also a comparison of the two methods of placing the thermometers:

		Brevicomis Tree Thermometers Inside Bark			Brevicomis Tree Thermometers Outside Tree			
Date	Hour of Reading*	Air Temp.	N	S	N	S	E	W
Dec. 31, 1927	8 a.m.	-6	6	4				
	9 a.m.	-4	7	5	1	6	6	-1
	10 a.m.	-1	7.75	6	3	6.2	11	1.75
	11 a.m.	2	8.75	7	4.2	7.2	11	3
	12 noon	3	9.75	6.75	6	8	11	4
	1 p.m.	4	10	8	7.75	9	11	6
	2 p.m.	5	10.75	9	9	9.75	11	7
	3 p.m.	5	10.75	9	8	9.75	16	6
	4 p.m.	5	10.25	9	7	9	16	4.75
	5 p.m.	4	10	9	6.75	9.75	16	5
	6 p.m.	3	10	8.7	6.7	9.2	15.7	5.2
	7 p.m.	4	10	8.8	7	9.3	15.7	5.8
	8 p.m.	3	10	8.8	7.4	Thermom. broken	12.7	6
	10 p.m.	4	10.5	9	8.1	8.1	13.9	6.8
Jan. 1, 1928	2 a.m.	2.75	5.25	4.75	4	3.75	6.75	3.5
	3:45 am	6	5.25	4.90	4.75	4.50	9	4
	8 a.m.	10	11	10	8	8	18	7
	10 a.m.	11	11.75	10	Thermom. broken	8	18	9
	12 noon	12	12	10.25	"	9	18	10

*Readings recorded by Evenden, Gibson and Rust

On April 11, 1928, an analysis of bark taken from the base of the yellow pine used in the experiment gave the following average of Dendroctonus brevicomis larvae per square foot of bark surface for each exposure:

North---168 active larvae South---390 active larvae
East---192 " West---401 "

As no evidence of mortality was found in conducting the bark analysis, it is believed that the low temperature prevailing from December 30, 1927, to January 2, 1928, had no noticeable effect on the overwintering larvae. H.J.R.

FOREST INSECT CONTROL IN WHITE PINE

During the coming season maintenance work will be continued in the Pete Creek Area, Kootenai National Forest, Montana. This project, which was started in 1926, was for the purpose of reducing an outbreak of the mountain pine beetle in the white pine stands of the drainage. Control measures will also be instituted during the season within the O'Brien Creek Area against a similar outbreak of this insect. There seems to be a rather general uprising of this insect throughout the white pine stands of the district, and the possibility of another severe epidemic is feared. J.C.E.

BIG HOLE BASIN PROJECT

In the continuation of the Big Hole Basin Control Project, Beaverhead National Forest, Montana, the sum of $95,000 will be spent during the months of May and June. This expenditure is necessary in order to check the spread of the mountain pine beetle epidemic, which for many years has been spreading south along the Continental Divide. This project was started in 1925 and will be continued as long as the epidemic continues to spread into the area. J.C.E.

THE DENDROCTONUS POPULATION OF A SINGLE YELLOW PINE

During the winter of 1913, Entomological Ranger J.D. Riggs carefully counted the western pine beetles living in the bark of a yellow pine at Bray, Siskiyou County, Calif. The tree was 32 inches in diameter at the base and had an infested length of 102 feet. The top diameter of the infested length was 14 inches. The bark was carefully shoved away and the larvae and young beetles counted with a tally register as they were exposed to view. There were found 33,230 *Dendroctonus brevicomis* Lec. larvae and young beetles, 21 Ostomid (*Trogosita virescens*) larvae, 4 Ostomid beetles and 8 *Cucujus clavipes* beetles. The Dendroctonus from about ten square feet of bark had been destroyed by woodpeckers. H.E.B.

FIR TUSSOCK MOTH TO THE FRONT

From District 4 we have a report of the defoliation of alpine fir by an insect determined as the fir tussock moth, *Hemerocampa pseudotsuga* McDunnough. The area infested, which is near Jarbidge, Nevada, is at this time confined to some thirty acres, on which over half the trees are attacked. The current year's growth seems to be most attractive to these insects as a food supply, but after this is exhausted the older needles are eaten. Artificial control measures, consisting of felling and burning the infested trees, were planned for the present winter, but as yet results are in doubt. J.C.E.

PART OF THE $45,000,000

According to Bureau of Entomology estimates, damage to wood products by insects in the United States causes an annual loss of at least $45,000,000. California undoubtedly has to stand its share of this huge loss, a great deal of which could be prevented by the application of methods of control recommended by forest entomologists. During March an employee of a San Francisco insurance company brought to the California district office a desk partially destroyed by powder post beetles, and reported large, expensive counters in his office also attacked.

HOW FAR DO BARKBEETLES FLY?

As soon as the forester learns that after a brood of barkbeetles emerges from one tree it moves on to concentrate its forces in an attack on another tree, the inevitable question of flight comes up. How far do beetles travel when they leave one tree to go to another? Many phases of barkbeetle control hang upon the answer to this question. The rate of spread of an epidemic, the size of the area that should be included in a control project, the barriers that should be effective in protecting an area from a nearby infestation, all hang upon the flight habits of the beetles.

Although the entomologist has been able to pry into many of the personal affairs of the western pine beetle during the stages of development in an infested tree, very little is known of what the beetles do between the time when they emerge from one tree as new adults and the time when they finally enter a new tree to establish a future home. After 20 years of study of the western pine beetle problem, this period of the insect's existence is still very much of a mystery.

This is probably due to the fact that these insects are very difficult to follow when in flight, so that little evidence can be secured by visual observation. It is therefore necessary to establish our conclusions by direct evidence, whereby we can identify the beetles that attack one tree as having come from another tree; or else by inference assume that the beetles which attack came from the nearest infested tree, and that the distance between these two trees represents the probable distance of flight.

It has been found that when a large quantity of western pine beetle-infested bark is piled up in the forest, only a few of the emerging beetles attack trees in the vicinity of the pile. The great majority move on to some other locality, which suggests a definite instinctive tendency to wander.

In 1916 Keen attempted to secure records of western pine beetle flight by the direct method of marking beetles and recovering them after they had attacked new trees. After considerable experimentation a method of marking with aniline dyes was worked out. Large numbers of beetles were successfully reared, marked with this dye and liberated. The results were largely negative, as none of the marked beetles were recovered, although several trees were attacked within half a mile of the liberation point.

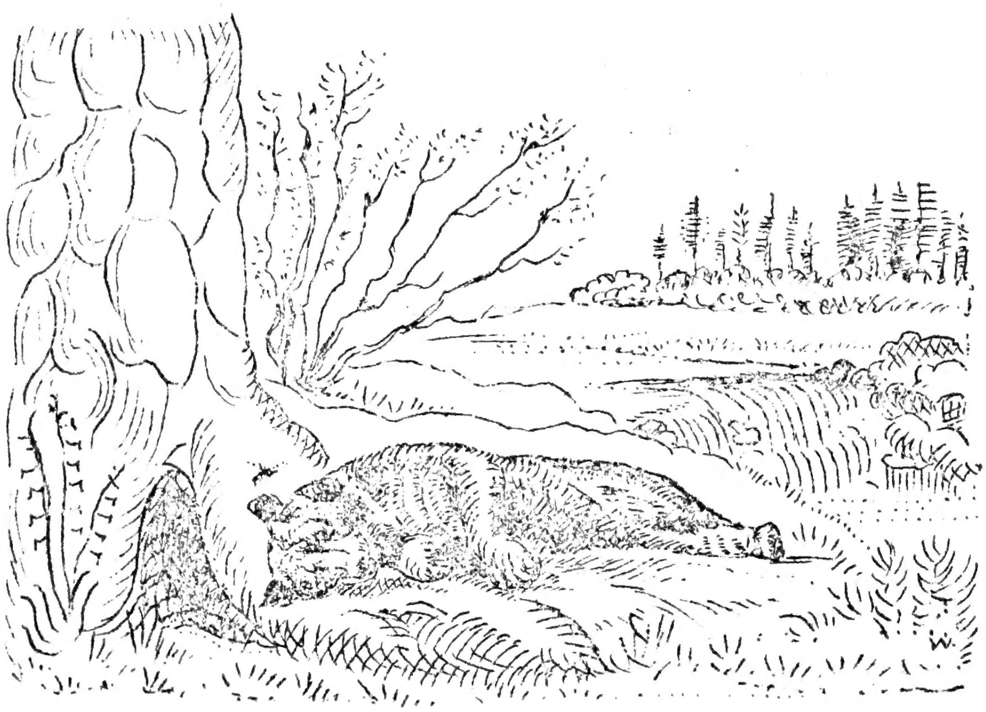
A number of records have been built up since then which indicate by indirect evidence the distance covered by this beetle in flight. One of the first of these was secured by Mr. Patterson in 1920 by falling a yellow pine trap tree at a considerable distance from the main timber belt. In this case beetles flew at least $1\frac{1}{4}$ miles to attack the tree in great numbers. A similar test was carried out by the writer on the Sequoia National Forest in 1918, where a flight of at least 1-1/8 miles was necessary to enable the beetles to reach a trap at the edge of the timber belt.

In 1924 Person and Miller established a series of flight records on the San Joaquin Project. A circular area, the Forked Meadow Unit, with a radius of about 1½ miles, was thoroughly combed by control work tomremove all the 1923 overwintering infestation. During the summer of 1924 this cleared area was so thoroughly reinfested by the western pine beetle that the volume of timber killed was more than twice that of the preceding year. It was found that this entire movement of beetles into the area could be accounted for by flights from tree to tree which did not exceed one mile at the maximum, and which averaged less than one-half mile.

A similar experiment was carried out on the Oat Mountain Area of the San Joaquin Project in 1925. In this situation the beetles could move into the cleared area only from the north and east. It was found that they spread across this cleaned area for distances of from 1½ to 2 miles during the course of two seasonal generations.

It is quite evident from the above records thatthese beetles do not stay out of an area after they have once been eliminated by control work. Just how much farther they may fly than the distances indicated by the above experiments is a matter of conjecture. Possibly some of them are potential Lindberghs!

J.M.M.



A Satisfied Termite Collector